2.5 Total Phosphorus Loading

Total phosphorus (TP) loading has also likely been affected by changes in land use from wetlands and forest to urban and agricultural areas leading to increased phosphorus loading to the estuary. This increased loading results in eutrophication within the estuary, as higher TP loading per unit area is common for the urban and agricultural land uses relative to those from wetlands and other natural land cover types. The runoff discharge model discussed previously was used to estimate relative TP loading rates for the basins.

Monthly-specific TP loading estimates were determined for each individual parcel of urban and agricultural land within a tertiary basin. Loadings were computed using runoff coefficients (Appendix B) specific for south Florida, with variation by land use/cover and hydrologic soil group, and adjusted for wet or dry season conditions. Loading estimates for each individual urban and agricultural land parcel within a tertiary basin were then summed to compute the TP loading for that tertiary basin and month, as follows:

$$TPL_{j,t} \text{ ' } \hat{q}_{j,t}\ B_l$$

where: $TPL_{j,t}$ = estimated monthly TP loading in the t^{th} month for the j^{th} tertiary basin,

$\hat{q}_{j,t}$ = estimated total monthly runoff discharge in the t^{th} month for the j^{th} tertiary basin, as described previously, and

B_l = TP concentration for land use l.

Following the methodology used for the previously discussed criteria, the tertiary basins were assigned relative ranks according to estimated total annual phosphorus loading. This analysis resulted in the priority basins presented in Table 2-9; Table 2-10 presents the area-weighted relative ranks for annual TN loading. Figure 2-9 presents the results of the TP loading ranking of the 62 tertiary basins in the study area grouped as described previously into high, medium, and low impact basins. Figure 2-10 presents the area-weighted results of the annual TP loading ranking of the 62 tertiary basins in the study area.

Table 2-9. Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for total annual phosphorus loading.

Secondary Basin	Tertiary Basin	Area (acres)	% Urban Land Use	% Agricultural Land Use	Total Phosphorus Load (lbs/yr)	Rank
Imperial River	6	41568	3	25	70846.33	1
Estero River	8	27647	16	27	49644.51	2
Six-Mile Cypress Slough	4	18354	20	23	32390.96	3
Six-Mile Cypress Slough	1	8345	29	15	14534.26	4
Imperial River	4	4695	30	37	11715.97	5
Estero River	6	7467	15	27	9202.14	6
Six-Mile Cypress Slough	3	3893	42	13	7097.67	7
Ten-Mile Canal	11	2569	42	12	6884.77	8
Mullock Creek	4	3596	81	7	6799.45	9
Imperial River	1	3464	61	0	5798.08	10
Hendry Creek	5	1874	27	29	4883.05	11
Estero River	5	2460	41	17	4836.12	12
Hendry Creek	10	2459	59	0	4674.18	13
Barrier Islands	1	15726	13	0	4494.28	14
Spring Creek	7	2482	36	10	4178.42	15
Estero River	3	2699	14	15	3970.67	16

The top ranked tertiary basins in the Estero Bay Watershed for total phosphorus loading include three basins located in the eastern portion of the watershed that are larger than 18,000 acres in area, and have more that 20% of their land use in agricultural uses. These basins include TB 6 in the Imperial River Basin, TB 8 in the Estero River Basin, and TB 4 in the Six-Mile Cypress Slough Basin. The priority tertiary basins with respect to total phosphorus loading are very similar to those for total nitrogen loading, containing 15 of the same priority basins. Since both total nitrogen loading and total phosphorus loading are functions of freshwater runoff, differences in priority basins between the two criteria are due to the variation of land use-specific loading coefficients, which do not vary in similar manners for nitrogen and phosphorus.

The area-weighted rankings of the tertiary basins within the Estero Bay Watershed show that the top-ranked tertiary basin is TB 7 in the Cow Creek Basin. This is the only tertiary basin within the Cow Creek Basin in the high priority group. TB 11 in the Ten-Mile Canal is ranked second for area-weighted total phosphorus loading. All of the top 25% of the tertiary basins have TP loads greater than 2 lb/yr/acre.

To provide a comparison with the area-weighted TP loadings from the basins in Table 2-10, values from drainage basins within the Charlotte Harbor National Estuary Program (CHNEP) study area may be used. The range of area-weighted TP loading from the major basins in the CHNEP study area was from 0.34 lb/yr/acre (for the Pine Island Sound/Matlacha Pass Basin) to 1.05 lb/yr/acre (for the Caloosahatchee River Basin) (PBS&J and Bender, 1998). The area-weighted TP loading from the entire Estero Bay Watershed is 1.56 lb/yr/acre (Appendix A).

Table 2-10. Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for area-weighted total annual phosphorus loading.

Secondary Basin	Tertiary Basin	Area (acres)	% Urban Land Use	% Agricultural Land Use	Area-weighted Total Phosphorus Load (lbs/yr)/acre	Rank
Cow Creek	7	621	78	4	3.54578	1
Ten-Mile Canal	11	2569	42	12	2.68013	2
Spring Creek	6	545	40	0	2.6564	3
Six-Mile Cypress Slough	5	653	14	29	2.63303	4
Hendry Creek	5	1874	27	29	2.60596	5
Spring Creek	5	88	91	0	2.51201	6
Imperial River	4	4695	30	37	2.49547	7
Mullock Creek	5	290	53	0	2.47242	8
Estero River	7	248	46	24	2.44086	9
Ten-Mile Canal	8	1441	11	42	2.41656	10
Hendry Creek	8	863	66	7	2.38358	11
Spring Creek	3	768	69	0	2.31095	12
Ten-Mile Canal	9	1266	53	24	2.25442	13
Spring Creek	2	868	63	0	2.20255	14
Ten-Mile Canal	6	1728	44	28	2.16375	15
Spring Creek	4	77	46	0	2.02751	16

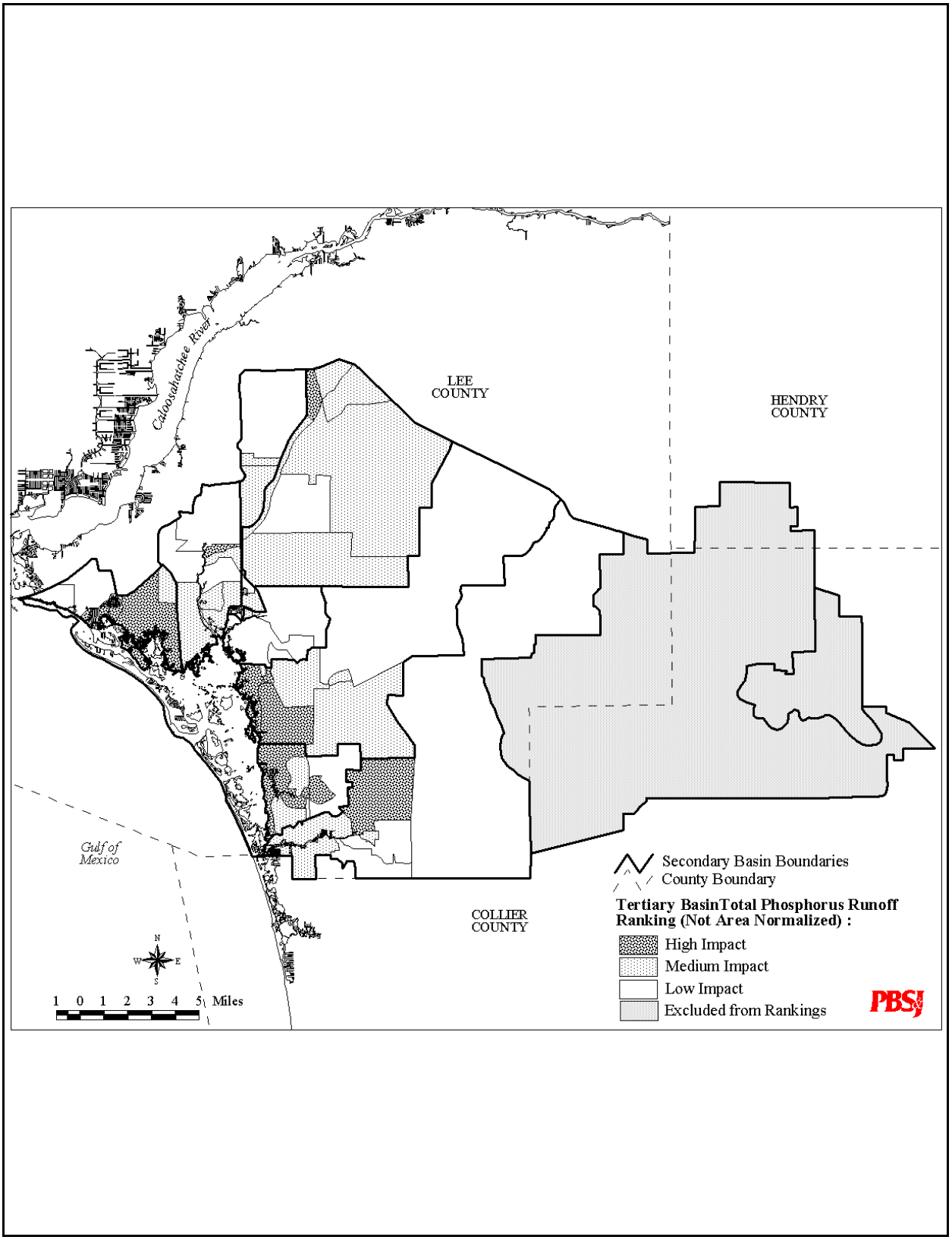

Figure 2-9. Tertiary basins classified by total annual phosphorus loading.

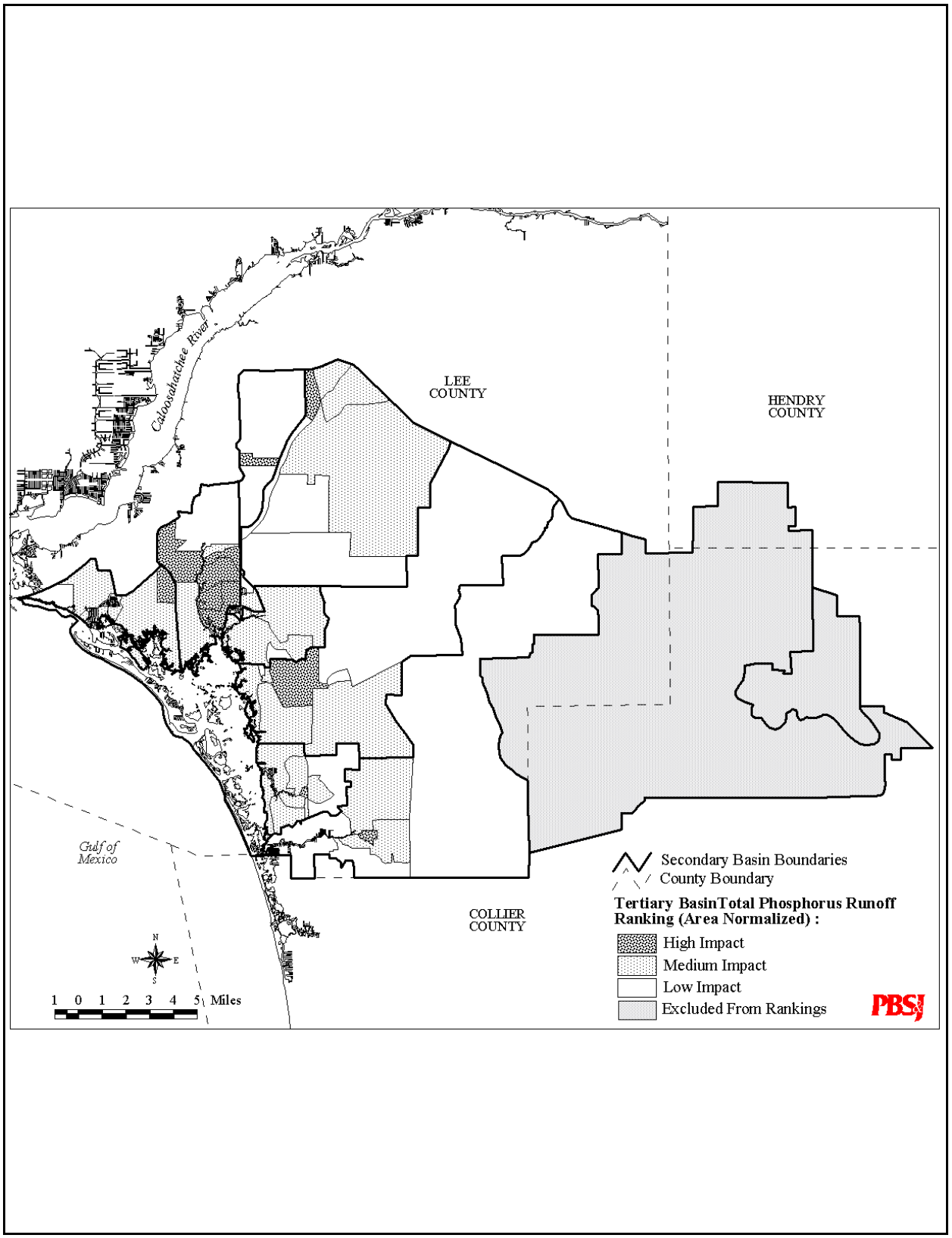

Figure 2-10. Tertiary basins classified by area-weighted total annual phosphorus loading.